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Drivers For Adopting Smart Healthcare Management Strategies: A Systematic Review Of Literature

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- **Summary:**

The healthcare sector is faced with a number of challenges including a growing and aging population, more people living with multiple long term illnesses and staff shortages. These challenges together with calls to improve efficiency and quality of care, the sector has turned to smart healthcare management strategies as a potential solution. The objective of this review is to systematically check published literature to identify and compile a comprehensive list of drivers that have intensified the adoption of smart healthcare management strategies. Knowledge of drivers for smart healthcare adoption is important to healthcare policymakers, leaders and clinicians wishing to adopt smart healthcare management strategies. EBSCOhost, PubMed, Scopus, Science Direct and ProQuest were searched for full text, peer reviewed, English language articles that reported the drivers for adopting smart healthcare. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were used to select eligible articles. After the full screening, 17 articles that met the criteria were analysed and used to identify 8 key drivers for adopting smart healthcare management strategies. The identified drivers are improved patient safety, improved delivery of care, cost savings, increased access to healthcare services, enhanced communication, enhanced data management and security, incentives or penalties and regulatory compliance. It is concluded that future research is needed in identifying key smart healthcare management strategies and challenges faced when adopting smart healthcare management strategies.

Keywords: Healthcare services, smart technology, smart healthcare, drivers, cost savings, and patient safety

- **Track 22:** Organisational Transformation Change and Development

- **Word count:** 6915

Introduction

The healthcare sector is facing numerous challenges, pressures and calls to improve efficiency as demand for services are at a rise. This rise on hospital activities is mainly due to the change in demographics and that more people are living with complex long term health conditions (King's Fund, 2019). According to the ONS (2020) the population of the UK is projected to increase by 3.0 million (4.5%) in the first 10 years of the projections, from an estimated 66.4 million in 2018 to 69.4 million in 2028. The UK has an ageing population (ONS, 2018). There are nearly 12 million people aged 65 and above in the UK of which: 5.4 million people are aged 75+; 1.6 million are aged 85+; Over 500,000 people are 90+; and 14,430 are centenarians (ONS, 2018). An aging population is positively related to chronic illnesses requiring increased usage of healthcare resources (Kruse *et al.,* 2018). This means demand on services is on the rise as more people are living longer with complex healthcare issues such as diabetes, cardiovascular and respiratory diseases (King's Fund, 2019). National Health Services (NHS) have become overwhelmed with this demand resulting in over-reliance on private services which are very costly. Additionally, new emerging medical technologies that enable more people to be treated within a short period of time are becoming available however these advances come at a cost and are estimated to cost the NHS £10 billion a year (The Medical Portal, 2019). All these factors have brought about an increase in healthcare spending causing a mismatch with available budgets (The Medical Portal, 2019). This mismatch of funding and costs has driven healthcare organisations to close local services which only results in further strain on hospital activities.

Healthcare providers are facing shortage of clinicians such as doctors and nurses and it is an enormous challenge for healthcare organisations to recruit and retain clinicians (The Medical Portal, 2019). A shortage of trained clinicians impedes appropriate delivery of care and treatment to patients (Poudel and Nissen, 2016). These major challenges have driven healthcare organisations to rethink the way services are delivered in order to respond to this rise in demand and still continue to deliver safe and high quality care with positive outcomes to patients.

With smart technology speedily transforming people's lives, smart healthcare strategies have emerged as a potential solution to overcome these challenges. Smart technologies refer to entities where physical devices or processes are complemented with the smart properties of digital technologies. According to van Doorn (2015) smart technologies are technologies that use electronic devices or systems that can be connected to the Internet, used interactively, and are to some extent intelligent. Treisman *et al.* (2016) defined smart healthcare as a collection of mobile devices, web based applications and digital technologies that improve the delivery of healthcare. Smart healthcare uses a new generation of information technologies, such as the internet of things (loT), big data, cloud computing, and artificial intelligence, to transform the traditional medical system in an all-round way, making healthcare more efficient, more convenient, and more personalized (Tian, *et al.,* 2019). There is no distinction between smart healthcare and eHealth and are considered as interchangeable throughout literature to encompass a variety of Information and Communication Technology (ICT) based healthcare deliverance.

Smart devices such as smart phones and tablets have almost become ubiquitous offering all-encompassing connectivity and ability for people to capture, monitor and share information through wireless networks and cloud based storage (Treisman *et al.,* 2016). Several sectors such as banking, transport, retail and energy have turned to smart strategies to improve performance and productivity, reduce costs, increase user satisfaction and improve sustainability. Successes in other

sectors has driven the healthcare sector to explore and adopt smart strategies as a solution to the challenges faced by the sector. Furthermore, an increase of demand in healthcare has resulted in the development of new policies and practises to support community based care instead of hospitalisation which has further increased the commitment of use of technology in healthcare (Porter *et al.,* 2018).

It is therefore important for everyone within healthcare including policy makers, healthcare leaders, healthcare providers and clinicians to understand the drivers and benefits of adopting healthcare strategies. Knowledge and understanding of drivers for adopting smart healthcare management strategies empowers policy makers use the knowledge increase adoption of smart healthcare in the sector while leaders use the knowledge as leverage to stress opportunities presented by adopting smart healthcare management strategies. From the perspective of healthcare providers and professionals, this knowledge promotes acceptance and integration of smart healthcare strategies in the current delivery system.

It is therefore important to review up to date published literature on smart healthcare strategies to explore and document drivers that facilitate the adoption and use of smart healthcare strategies in clinical practise and the health sector as a whole so that healthcare policy makers, leaders, providers and professionals have an evidence base which demonstrates the effectiveness and benefits of how smart healthcare strategies can address current challenges and improve productivity for better health outcomes.

Methodology

A systematic review is used for this paper to review relevant literature guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement to answer the question: What are the key drivers that have intensified the adoption of smart strategies in the UK health sector? Initial scoping was conducting by using the search terms ("smart health" OR "ehealth" OR "telehealth" OR "mhealth") AND ("adoption" OR "implementation") AND ("drivers" OR "benefits") to identify relevant electronic databases and journals. Following the initial scoping, electronic databases EBSCOhost, PubMed, Science Direct, Scopus and ProQuest were selected for this literature search. These databases were selected due to the reputation and variety of citations which cover the topic of this review. As different databases focus on different subject areas, inclusion topics were spread as shown in the table below.

Table 1: Criteria for topic inclusion

EBSCOhost	**PubMed**	**Scopus**	**Science Direct**	**ProQuest**
Business source complete	All topics included	Medicine	International Journal of Medical Informatics	ABI/INFORM Global database
CINAHL, MEDLINE and PsycINFO databases		Computer science	Health Policy	Nursing and Allied Health
Computer source		Nursing		
Regional Business News		Health professionals		

Table 2: Article inclusion and exclusion criteria

	Inclusion	**Exclusion**
Location	USA, Europe, Canada and Australia	All other geographical locations
Research methods	All research designs thus, qualitative, quantitative and mixed methods	
Setting	Healthcare setting e.g. hospital, doctors' surgery, local clinics etc.	Non-healthcare setting
Types of studies	Articles from the perspective of a patient, healthcare professional and IT professionals in a health related roles.	Studies purely focussed on technology infrastructure and applications for example Internet of Things.
Data collection timing	Data collection carried out between January 2015 and April 2019	Data collection carried out before January 2015

The key words used to search all 5 databases were designed to capture all-digital, mobile and advanced technology within healthcare settings: ("smart health*" OR "ehealth*" OR "electronic health*" OR "e-health*" OR "mHealth*" OR "m-health*" OR "mobile health*" OR "tele*" OR "Health Information System" OR "Health Information Technology" AND ("adoption" OR "implementation" OR "acceptance" OR "approval" OR "recogni*") AND ("drivers" OR "advantages" OR "benefits" OR "use*" OR "factors" OR "values" OR "facilitators" OR "strength".)

During the extraction of articles, an advanced search tool was used to filter and limit articles to only identify the full text, peer reviewed, English language articles published between January 2015 and April 2019 (last 5 years). This is because technology is a fast paced, rapidly evolving field thereby important to avoid discussion of any out-dated technologies. Additionally only full text articles were selected thereby excluding any conference abstracts, book chapters, blogs and health website contents.

Article screening and selection

Identified articles were then screened for duplicate entries. Because several databases were used, there was a high possibility that some articles would have been published in more than one database. Once the duplicates were discarded, titles and abstracts were screened for eligibility. A full text review was then carried out for the remaining articles to identify the articles that met the pre-defined inclusion/exclusion criteria as shown below. As shown in the PRISMA diagram, the search retrieved 11260 articles and nine additional records were identified from other sources. All 11269 articles were screened for duplicates and 3175 duplicates were identified and excluded. Title and abstract screening was conducted on the remaining 8085 articles and 101 potentially eligible articles were selected for the next stage. A full-text review of the remaining 101 remaining articles was then conducted using inclusion

and exclusion criteria described in the earlier article screening and selection section and a total of 17 articles were identified as eligible and therefore analysed for this systematic review.

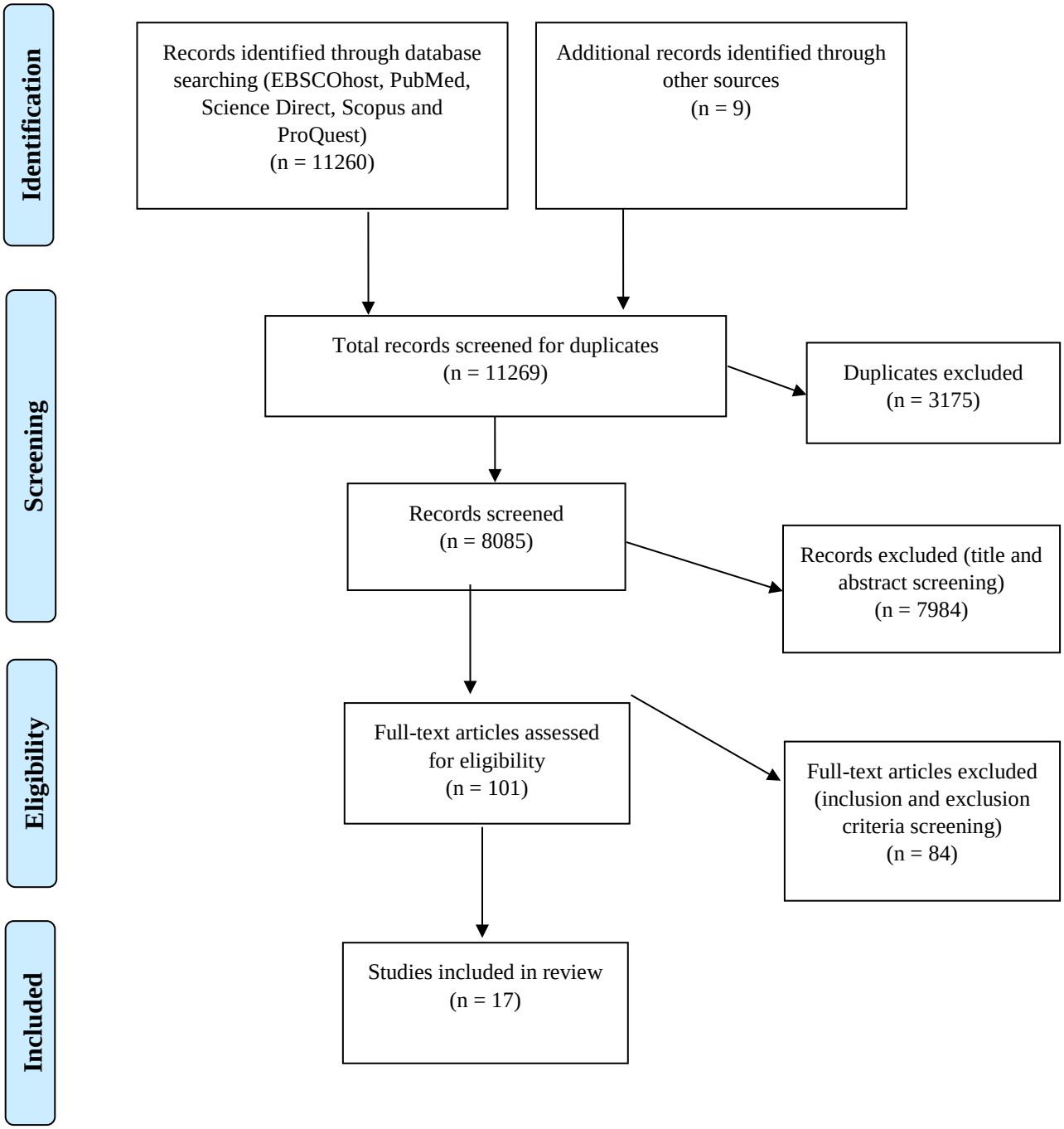

Figure 1: PRISMA article screening process

Findings

After reviewing relevant literature, there are 8 main smart healthcare adoption drivers that emerged as illustrated in Table 3 below.

Table 3: Key drivers for adopting smart healthcare management strategies

Driver	**Sources**	**Description**
Improved patient safety	Batra et al. (2017) Bele et al. (2019) Feng et al. (2019) Kruse et al. (2015) Nguyen et al. (2015) Tao et al. (2015) Treisman et al. (2016) Zulman et al. (2015)	Patient safety is the avoidance of harm either expected or unintentional during provision of care.
Improved delivery of care	Bele et al. (2019) Eysenbach et al. (2015) Kruse et al. (2018) Kruse et al. (2018b) Melchiorre et al. (2018) Mileski et al. (2017)	Delivery of care are the methods and techniques used to provide healthcare services to bring about a desired health outcome
Cost savings	Bele et al. (2019) Kruse et al. (2015) Kruse et al. (2016) Kruse et al. (2018) Melchiorre et al. (2018) Mileski et al. (2017) Poudel and Nissen (2016)	Reduction of expenses thereby saving more than planned
Increased access to healthcare services	Batra et al. (2017) Bele et al. (2019) Melchiorre et al. (2018) Mileski et al. (2017) Poudel and Nissen (2016) Treisman et al. (2016) Zulman et al. (2015)	Ability to access healthcare services as and when needed regardless of geographical location or time

Enhanced communication	Bele et al. (2019) Kruse et al. (2015) Kruse et al. (2018) Kruse et al. (2018b) Melchiorre et al. (2018) Mileski et al. (2017) Nguyen et al. (2015) Treisman et al. (2016) Winters et al. (2018) Zulman et al. (2015)	Ability to effectively share and exchange information, co-ordinate and collaborate activities within different teams, departments or services such as primary, acute or mental health services
Enhanced data management and security	Batra et al. (2017) Kruse et al. (2015) Kruse et al. (2018) Kruse et al. (2018b)	Secure collection, storage, use and dissemination of patient data within health services
Incentives or penalties	Huang et al. (2018) Kruse et al. (2015) Kruse et al. (2018)	These are both financial and non-financial benefits or dis-benefits presented to promote adoption of smart healthcare strategies
Regulatory compliance	Kruse et al. (2016) Treisman et al. (2016)	The need to comply with regulations motivates healthcare providers to adopt smart healthcare strategies

1. Improved safety

One of the main objectives of any healthcare organisation is to provide safe care to patients and the adoption of smart healthcare improves the safety of care provided to patients. Poor or non-adherence with treatment remains a well-known safety issue and clinical practise challenge with a quarter of patients especially those with chronic illnesses known not to adhere with treatment (Tao *et al.*, 2015). Treisman *et al.* (2016) agree with this notion and confirm that 50% of patients diagnosed with schizophrenia are not concordant with prescribed medication which is dangerous and may result in relapse, rehospitalisation or suicide.

The adoption of smart healthcare strategies can improve patients' compliance with treatment regimes especially adherence with medication (Zulman *et al.*, 2015). According to Batra *et al.* (2017) smart healthcare strategies allow for better assessment of treatment adherence. Smart healthcare makes use of wearable sensors that are used by clinicians to monitor health activities by taking real time measurements such blood glucose and blood pressure levels. This accurate collection of measurements from wearable sensors aids clinicians to make informed treatment decisions which reduce unintended errors or harmful actions. It is argued that the monitoring feature of sensors is not always useful for improving treatment adherence for example with patients reluctant to take medication or not up out clean about missed doses. In such cases a smart pill which is another smart healthcare strategy, can be utilised to point out whether or not

and when medication was taken by recording medication ingestion levels (Treisman *et al.*, 2016).

Often poor adherence with treatment is a result of for patients forgetting to take medication or attend appointments with clinicians. Findings from a meta-analysis carried out by Tao *et al*. (2015) reveal that use of electronic reminders is a modest but effective way of promoting adherence to medication and treatment in patients. This is supported by Batra *et al*. (2017) who point out that the use of smart healthcare for electronic alerts and reminders support patients to take medication doses on time and attend scheduled appointments thus adhering to treatments plans.

Another safety concern pointed out by literature is lack of information on patient medication and/or allergies. Kruse *et al*. (2015) pointed out that smart healthcare enables clinicians and patients to set medication and allergy alerts for use by clinicians thereby reducing unintended medication errors and adverse drug events. Nguyen *et al.* (2015) further explain that real time notification of events such as allergies, lab results, potential medicine issues and changes in patient conditions provide critical and more accurate information which facilitates rapid responses, improves safety and results in better patient outcomes.

Feng *et al.* (2019) who define Adverse Drug Events (ADEs) as expected or unexpected effects caused by medication errors or drug interactions state that the use of smart health reduces the occurrences of ADEs. This is because the use of electronic monitors and triggers provide clinicians with complete real time data used to identify ADEs and take corrective measures before harm occurs to the patient. With healthcare activities being moved to outpatient rather than inpatient care, ADEs usually go undetected in outpatient care due to poor recording and communication of information but use of electronic monitors and sensors enable complete and accurate recording of health data enabling clinicians to make accurate informed decisions during reviews (Nguyen *et al.*, 2015). This is supported by Feng *et al.* (2019) who go further to explain that accurate detection of ADEs greatly relies on fast and excellent medication reviews. The emergence of smart healthcare strategies provides clinicians with clinical decision support systems that make the review process considerably faster and less resource intensive enabling clinicians to identify ADEs quicker.

2. Improved delivery of care

Every healthcare provider exists to deliver quality care of the highest standard. Provision of quality patient centred and co-ordinated care is presently a high priority area within healthcare. Delivery of quality care promotes preventative care which results in people living healthier lives and requiring fewer admissions to hospital thereby reducing pressure on the already stretched healthcare services (Kruse *et al.*, 2018b). The adoption of smart healthcare strategies facilitates various ways of delivering high quality preventative care by efficient gathering and dissemination of health information and accessibility of evidence based guidelines (Eysenbach *et al.*, 2015).

Before, ill people expected to be admitted into hospitals however global population growth has resulted in available hospital beds no longer being proportionate to the number people needing these. This has forced the healthcare sector to rethink the way healthcare is delivered as the traditional methods of healthcare delivery are no longer feasible. Alternative methods include provision of care in the community thus in patients homes. Furthermore, most people prefer to be treated in the comfort of their own homes rather than in hospital setting. Therefore, the

ability to provide healthcare in the community is vital and a key driver to the adoption of smart healthcare strategies (Mileski *et al.,* 2017). Bele *et al.* (2019) discuss that the adoption of smart healthcare strategies facilitates for remote healthcare delivery and management thereby aids for community care. Also, remote healthcare reduces patients' length of stay in hospitals. Bele *et al.* (2019) further explain that the ability to collect healthcare data whilst someone is in their homes to facilitate for more accurate and reliable information gatherings without the involvement of clinicians and other factors that are associated with being in a hospital environment. This enables clinicians to gain a clearer picture of how patients manage health on a daily basis.

Additionally, a study carried over 20 months period between five long term care facilities and relative emergency departments revealed that adoption of smart healthcare strategies reduced amount of hospital readmissions which emphasis the improvement of quality of care delivered to patients (Kruse *et al.,* 2018). This is supported by a study carried out by Melchiorre *et al.* (2018) in Cyprus general hospital which also reveals the reduction of hospital readmissions after the adoption of smart healthcare strategies. Both sets of authors agree that adoption of smart healthcare strategies improves the monitoring of patients health which improves the decision making of treatment plans by clinicians. Additionally, the close monitoring ensures patients and clinicians stay in contact enabling quickly identification of any deterioration in patients' health and remedial actions to be put in place. This value based, patient centred delivery of healthcare aids the reduction of hospital readmissions.

3. Cost savings

Adoption of smart healthcare strategies is driven by the necessity to reduce on expenses and make savings on planned budget by improving processes, reducing time taken to complete tasks and reducing unnecessary waste. Kruse *et al.* (2016) found out that in 2014, 55% of healthcare providers that had achieved the HITECH Act had made financial savings of about 77-371 billion dollars throughout the USA. This is supported by Kruse *et al.* (2018) who suggested that these savings were a result of waste reduction associated with duplicate orders, tests and prescriptions made possible by the adoption of smart healthcare strategies which facilitates for seamless, fast and secure exchange of patient information at multiple levels and between multiple providers and clinicians.

Another reason of cost reduction after adopting smart healthcare strategies as explained by Bele *et al.* (2019) is that patients ready for discharged and do not stay in hospital longer than required. This is due to the fact that adoption of smart healthcare strategies enables the provision healthcare from a distance i.e. at home through the use of remote monitoring and communication. This means that hospitals activity is reduced; more beds are available to admit more acutely unwell patients that need hospitalisation instead of sending patients to private hospitals that cost more. This is particularly true for NHS in the UK were costs for private services are paid for by the NHS in the event that the NHS sends patients to the private hospital when there are no beds available in NHS hospitals. This is reinforced by Mileski *et al.* (2017) who noted that healthcare providers that adopted smart healthcare strategies experienced higher patient volumes and increased spaces in facilities.

Poudel and Nissen (2016) and Bele *et al.* (2019) concur that the adoption of smart healthcare reduces time and money spent by clinicians travelling to visit patient homes as reviews and monitoring is done remotely. Additionally, wages and salaries bill of clinicians is reduced as lesser clinicians are required when using smart healthcare strategies. For example, the use of

smart healthcare reduces five nurses needed to do home visits to just two as use of smart healthcare eliminates travel time which means more patients can be reviewed per day.

Melchiorre *et al.* (2018) and Mileski *et al.* (2017) agree that 95% of providers using smart healthcare reported faster efficient processes due to the ability to automate processes, carry out required tasks anywhere at any time and receive tailored reminder alerts when tasks are to be carried out. This further explained by Kruse *et al.* (2015) who highlighted that streamlining of processes improves staff satisfaction and retention.

4. Increased access to healthcare services

With the population increasingly growing, demand of services has also increased making access to healthcare services increasingly difficult. For example in England patients have to wait longer than previously to get a GP appointment. According to Poudel and Nissen (2016), access to healthcare services is also affected by geographical factors. This is supported by Treisman *et al.* (2016) who reiterate that specialist services are often scarce and located miles away from patients. This results in longer waits and delay in getting vital treatment. However, adoption of smart healthcare strategies through the provision of remote healthcare assists patients to access specialist services and begin recovery journey quicker.

The use of smart healthcare strategies such as video conferencing has improved access to services such as patient counselling, education, consultation and reviews becoming routinely available. Bele *et al.* (2019) noted that smart healthcare improves access to health services by bridging geographical barriers and providing care over a distance. Zulman *et al.* (2015), Batra *et al.* (2017) and Melchiorre *et al*. (2018) concur with this notion pointing out that remote consultations enable ease of access to services and provides self-management support to patients being cared for outside the hospital setting.

Poudel and Nissen (2016) noted that healthcare providers are faced with missed appointments which cost millions every year. Most appointments are missed because of travel issues, other commitments such as work or patients especially elderly people unwilling to leave their homes. However, with the adoption of smart healthcare strategies healthcare providers are able to deliver services such as consultations at a more convenient time and location for the patients therefore reducing the amount of missed appointments and associated costs. This is also echoed by Mileski *et al.* (2017) who confirm that the availability of smart healthcare strategies enable healthcare providers to reach out to a broader population that may otherwise struggle to access services or refuse to go to hospitals or to GPs surgeries by providing healthcare in preferred locations.

Ability to access healthcare services quickly improves patient satisfaction. This is indicated by a study carried out by Poudel and Nissen (2016) in the USA which revealed 75% of the patient population was satisfied with the ability for healthcare to be provided anywhere, at any time and in the comfort of your own home.

5. Enhanced communication

Ability for any organisation to communicate quickly and effectively is important in any sector but more so in healthcare. In the healthcare sector there is need for fast and reliable exchange and continuously flow of crucial information between different teams and healthcare providers to ensure delivery of quality care to patients (Nguyen *et al.*, 2015). Additionally, instant

communication is important between clinician and patients especially when patient's health is managed in the community (Mileski *et al.*, 2017). Findings from a systematic review of literature by Nguyen *et al*. (2015) showed that in a previous study, 80% of the nurses that took part in a survey afformed that use of smart healthcare strategies permitted ease of sending urgent messages to doctors which facilitated for quick response on problems before developing into crisis.

Kruse *et al*. (2018) stated that adoption of smart healthcare strategies improves integration and co-ordination through effective internal and external communication between healthcare providers and clinicians. Melchiorre *et al.* (2018) and Treisman *et al.* (2016) concur that presently many people are living with multi illnesses and care which is managed by a number of clinicians and/or healthcare providers therefore healthcare systems need to be designed to communicate with each other and remove fragmented data. Failure of systems to communicate, exchange information and co-ordinate may result in unintentional errors caused by lack of information. Nguyen *et al*. (2015) further explain that some medical errors transpire as a result of communication gaps especially when different healthcare providers or clinicians are involved. However, introduction of smart healthcare systems integrates different systems and removes fragmentation and gaps in information. This facilitates for secure, fast and instant communication which removes communication gaps and permits for multi-disciplinary collaboration and continuity of care. Additionally, the need to share and exchange information with other healthcare providers or clinicians that have already adopted smart healthcare has obliged laggard providers that to adopt smart healthcare in order to share and compete with the fast adopters (Kruse *et al.*, 2018).

Face-to-face information dissemination from healthcare providers to both staff and patients is essential but not always possible. Ability to access information remotely where provision of face-to-face interactions, geographical location and time are restricting factors is made possible by smart healthcare features such as eLearning packages, blogs, video conferencing, electronic educational resources, electronic guides and virtual support groups (Kruse *et al.*, 2015 and Nguyen *et al.*, 2015 and Winters *et al.*, 2018). All these features support and provide important information that patients can use to understand and manage healthcare conditions, educate on available services and help patients prepare for planned meetings or discussions with clinicians (Zulman *et al.*, 2015).

Furthermore, smart healthcare strategies allow for the creation and maintenance of support networks that both clinicians and patients use to stay connected, support and share information, ideas and resolve issues (Bele *et al.*, 2019). Besides social networks, clinicians use smart healthcare strategies for continuous professional development purposes such as mentoring, coaching, training and provision of supervision which greatly improves staff satisfaction which is then transferred to delivery of quality care to patients (Winters *et al.*, 2018).

6. Enhanced data management and security

Kruse *et al.* (2018b) explained that smart healthcare strategies provide secure collection, storage, access and retrieval to patient data. This sentiment is also shared by Kruse *et al.* (2015) who explain that smart healthcare enables rapid and safe retrieval of patient records. Data is an essential asset in the healthcare sector and unavailability of data greatly affect provision of care to patients. Clinicians all need information to make accurate decisions regarding patients care. Also, most of the data held and used in healthcare is highly sensitive and confidential therefore it is paramount that data is gathered, stored, used and disseminated safely. Failure to keep data

secure may result in data ending up in the wrong hands and used wrongly which causes harm and problems to both the patient and healthcare provider. Therefore it is essential that data in managed securely and used in line with law that govern data usage.

As data in important in provision of healthcare, it is important that it is readily available and can be transferred accurately and instantly if need be. Batra *et al* (2017) suggest that smart healthcare strategies enable the collection and storage of data centrally which facilitates for more accurate and complete patient record compared to paper records. This is supported by a study carried out by Kruse et al. (2018), which highlights that clinicians were of the perception that use of smart healthcare strategies made clinical data transfer much easier as compared to fax and courier which is still mostly used in healthcare. Availability of accurate reliable data allows clinicians to gain a full comprehensive picture enabling a total understanding of the patient's health which aids for timely interventions. However, inefficiencies in data transfer and exchange may result in complicated health outcomes leading to readmissions, long hospital stays and increased costs. To ensure that patients receive quality care and good outcomes, availability of accurate data is paramount. This is pointed out by Batra *et al.* (2017) who note that availability of consistent and accurate real-time medical information including an in-depth patient history enable better assessments, informed decisions on diagnosis and treatment and quick intervention by clinicians. Readily available information eliminates the need to constantly request information from a different providers or clinicians and having to wait for the information to be sent back. This reduction in waiting time is essential as it may sometimes determine the health outcome for the patient.

On the other hand it can be argued that availability of large amounts of data may cause information overload. This is overruled by Kruse *et al.* (2018b) who note that smart healthcare strategies can quickly categorise, analyse and interpret large amounts of data when queried thereby providing specific required information and additional screening which is also essential for data centred activities such as research. The authors further explain that analysed data is used to better manage the public health as filtering and screening capabilities enable fast identification of population areas with higher risk factors and improve tracking and predictions of outbreaks empowering healthcare providers to provide targeted healthcare interventions which are efficient and cost effective.

7. Incentives or penalties

One big driver for adoption of smart healthcare strategies is the provision money to support the adoption. According to Huang *et al*. (2018) some governments including the UK have provided funding and introduced incentives to encourage healthcare providers to adopt smart healthcare strategies. In USA an example of such incentives is the Meaningful Use incentive supported by the Health Information Technology for Economic and Clinical Health (HITECH) Act 2009. Kruse *et al.* (2018) state that the HITECH initiative allocated over $560million to states in order to develop smart healthcare strategies. The authors further explain that such government/state funds have provided adequate finances to healthcare providers to adopt smart healthcare strategies which in some cases are unaffordable to healthcare providers. This is supported by Kruse et al. (2015) who noted that the provision of incentives through the HITECH act of 2009 is clearly a reason to adopting smart healthcare strategies as the funds provided are used to cover adoption costs which are a significant barrier to smart healthcare adoption.

Incentives are not always financial but can also be non-financial. This is elaborated by Kruse *et al.* (2015) who state that provision of technical support is a major incentive and driver in the adoption of smart healthcare strategies. Technical support costs healthcare providers a lot of money and may sometimes deter healthcare providers from adopting smart healthcare strategies. However, the provision of technical support promotes adoption as knowledge that technical support is available promotes adoption of smart healthcare.

Regulators and policy makers sometimes use penalties to motivate healthcare providers to adopt smart healthcare strategies. The threat of incurring penalties which can either be financial or non-financial such as operational restrictions is a proven driver to get any strategy or initiative adopted and adhered to.

8. Regulatory compliance

The drive to adopt smart healthcare strategies can also occur from the need to comply with regulations, standards or legislation that governs the healthcare sector as failure to do so may results in penalties, poor performance ranking or even closure of the organisation. Kruse *et al*. (2016) and Treisman *et al.* (2016) concur that the HITECH Act and the Affordable Care Act were important pieces of legislation that speeded up the adoption of smart healthcare strategies in the USA.

In the NHS in England, a regulation was passed from October 2018, payments to healthcare providers will only be made for activities resulting from referrals made via the Electronic Referral (e-Referral) system (NHS Digital, 2019). This regulation would have motivated most if not all healthcare providers in England to adopt smart healthcare strategies in order to be paid for activities undertaken by the healthcare provider. This shows that regulations are a major driver to adoption of smart healthcare strategies as the need to comply sometimes forces healthcare providers to adopt strategies that the provider might otherwise be reluctant to adopt.

Discussion

Out of the 17 articles that were synthesised eight key smart adoption drivers were identified and discussed. Enhanced communication was the most mentioned driver being identified in 10 articles selected for this literature review. This is followed by improved safety that was mentioned in 8 articles then cost savings and increased access to healthcare that were both mentioned in seven articles. Improved delivery of care was mentioned in six articles followed by enhanced data security, incentives and penalties; and regulatory compliance that were mentioned in four articles respectively.

The frequency that drivers are discussed in articles does not necessarily mean the driver with the highest frequency is the most important but it assists healthcare leaders and policy makers prioritise and maximise levels of commitment for adopting smart health management strategies. Additionally, some of the drivers are intertwined or leads to the next driver for example enhanced communication and improved delivery of care can be discussed as one driver. When communication between clinicians and patients is fast, effective and instant, it facilitates for improved delivery of care and improved safety.

Improved communication is a result of enhanced data management and security because if without secure collection, storage and dissemination of data, clinicians are unable to

collaborate to share the information. Moreover, accurate and readily available data facilitated by good data management and security ensures clinicians make the correct decisions which improve delivery of care and safety. This data is also used to check adherence with treatment which in turn improves safety and care delivered to patients.

Furthermore, adoption of smart healthcare strategies allows healthcare providers to comply with regulation, legislation and standards which does not only prevent healthcare providers from incurring penalties but can also attract incentives that facilitate adoption of smart healthcare strategies which aids automation of processes that reduce time, waste and payroll bill which results in overall cost savings.

Therefore, awareness and full understanding these drivers and interrelations of these drivers can assist healthcare policy makers and leaders educate clinicians and end users on the importance of smart healthcare strategies to get full acceptance and support to adopt these strategies and thereby improve organisational performance.

Conclusions and Recommendations

Change in demographics, shortage of clinicians and more people living with multiple healthcare conditions have greatly increased demand on healthcare services. Also with increasing calls to improve quality and safety of care whilst reducing cost, healthcare providers have turned to smart healthcare strategies as a potential solution to these challenges and demands. Based on the current literature, eight smart healthcare adoption drivers were identified and discussed. The drivers are improved safety, improved quality of care delivery, cost savings, enhanced communication, incentives or penalties, enhanced data management and security and regulatory compliance. These drivers are noted to be interrelated and often facilitate and support each other. Knowledge and understanding of these drivers greatly assist healthcare providers and policy makers to evidence the importance of smart healthcare strategies in order to gain support from clinicians and end users to successfully adopt the strategies and address current healthcare challenges as well as improve productivity for better health outcomes.

Further studies should concentrate on the key smart healthcare strategies. Although, numerous drivers for adopting smart healthcare were identified, failure to successfully adopt and deliver expected benefits still exist. It is therefore recommended that future studies investigate and analyse key challenges that healthcare providers face when adopting smart healthcare management strategies.

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